Noise

Affected Environment

Noise is commonly defined as unwanted sound that disrupts normal human activities or diminishes the quality of the human environment. ***Transient noise*** sources, such as passing aircraft or motor vehicles, produce noise usually of short duration excluded from regulation. Stationary sources such as a substation can emit noise over a longer period. ***Ambient noise*** is all noise generated in the vicinity of a site by typical noise sources such as traffic, wind, neighboring industries, and aircraft. The total ambient noise level is a typical mix of distant and nearby sources.

Sources of noise associated with electrical transmission systems include construction and maintenance equipment, transmission line ***corona***, and electrical transformer "hum." Corona is the partial electrical breakdown of the insulating properties of air around the transmission line wires. Corona-generated noise can be characterized as a hissing, crackling sound that is accompanied by a 120-***Hertz*** (***Hz***) hum under certain conditions.

Noise from transmission lines generally occurs during wet weather. Conductors can be wet during periods of rain, fog, snow, or icing. Such conditions are expected to occur approximately 15 percent of the time in the Spokane area and much less frequently at the western end of the project area..

Environmental noise, including transmission line noise, is usually measured in ***decibels*** on the A-weighted scale (***dBA***). This scale measures sound in approximately the same way the human ear responds. Table 3-21 shows typical noise levels for common sources expressed in dBA.

Table 3-2. Common Noise Levels

Sound Level, dBA*	Noise Source or Effect
110	Rock-and-roll band
80	Truck at 50 feet
70	Gas lawnmower at 100 feet
60	Normal conversation indoors
50	Moderate rainfall on foliage
40	Refrigerator
25	Bedroom at night
* Decibels (A-weighted) Sources: Adapted from Bonneville 1986, 1996.	

Noise levels and, in particular, corona-generated noise vary over time. To account for fluctuating sound levels, statistical descriptors have been developed for environmental noise. ***Exceedence levels (L levels)*** refer to the A-weighted sound level that is exceeded for a specified

percentage of the time during a specified period. Thus, L_{50} refers to a particular sound level that is exceeded 50 percent of the time.

Along the corridor of the proposed 500-kV transmission line, existing noise levels vary with the proximity to existing transmission lines and the proximity to other noise-generating activities. Except in the Grand Coulee and Spokane areas, most of the transmission line corridor is in rural, undeveloped areas. During foul weather, the existing parallel lines over most of the route would be a principal source of background noise, along with wind and rain hitting vegetation. In the more developed areas, traffic and noise associated with human activity are major contributors to background noise.

The Washington Administrative Code (WAC 173-60) specifies noise limits according to the type of property where the noise would be heard (the "receiving property") as well as land use of the noise source. Nighttime noise limitations in residential neighborhoods are 50 dBA; in commercial areas the limitation is 55 dBA; and in industrial areas the limitation is 60 dBA. Transmission lines are classified as industrial sources for purposes of establishing allowable noise levels at receiving property. Bonneville has established a design criterion for corona-generated audible noise from transmission lines of 50 dBA for the L_{50} (foul weather) at the edge of the right-of-way. Washington has interpreted this criterion to meet its noise regulations.

Environmental Consequences—Proposed Action

Impact Definitions

Impact levels are dependent on public and occupational use of the land. The potential for noise impacts increases in areas where human activities take place.

A **high** impact would occur if noise levels for the new line exceed existing state standards.

A **moderate** impact would occur if residents are present and nuisance noise levels occur, exceeding ambient noise levels during a portion of the time.

A **low** impact would occur if any contribution of the new line on ambient noise levels would not be easily perceived by nearby residents.

Impacts During Construction

Construction activities create noise that is short term and typically does not cause any serious disturbances to residents. Sources of noise associated with construction of the proposed project include

- construction of access roads and foundations at each tower site,
- erection of steel towers at each tower site,

- helicopter assistance during tower erection and stringing of conductors, and
- potential use of implosive fittings for conductor stringing.

Access roads and foundations at each tower site would be installed using conventional construction equipment (see Chapter 2). Table 3-3 summarizes noise levels produced by typical construction equipment that would likely be used for the proposed project.

Table 3-3. Construction Equipment Noise Associated with the Proposed Project

Type of Equipment	Maximum Level (dBA) at 50 Feet
Road Grader	85
Bulldozers	85
Heavy Trucks	88
Backhoe	80
Pneumatic Tools	85
Concrete Pump	82
Crane	85
Combined Equipment	89
Source: Thalheimer 1996.	

To account for fluctuating sound levels, statistical descriptors have been developed for environmental noise. The ***equivalent sound level (L_{eq})*** is generally accepted as the average sound level.

The overall noise caused by the conventional equipment involved in construction is estimated to be 89 dB L_{eq} at a reference distance of 50 feet. Noise produced by construction equipment would decrease with distance at a rate of about 6 dB per doubling of distance from the site. Based on that assumed attenuation rate, Table 3-4 shows the estimated construction noise levels at various distances from the construction site.

Although daytime construction activities are excluded from noise regulations, for this evaluation it was assumed that construction noise levels exceeding the Washington State limits for permanent industrial operations would constitute a temporary (several days at most) environmental impact. The Washington noise limit for noise levels at residential areas caused by permanent daytime industrial operations is 65 dBA. Construction noise levels would exceed Washington Department of Ecology daytime industrial operations limits at distances up to 400 to 800 feet from construction activity.

Construction noise impacts would not occur over most of the corridor due to its sparse development and population. Potential impacts during construction would be limited mainly to the Grand Coulee and Spokane areas. In Grand Coulee, residences in the small residential area near corridor mile 2/1, users of North Dam Park (corridor mile 2/2 to 2/3), and residents in

Delano Heights (east of corridor mile 2/4) could experience temporary construction noise impacts. In the Spokane area, residents in subdivisions between corridor miles 78/2 and 79/1 and between 82/8 and 83/3, and in the more dispersed residential area between 79/9 and 81/9 would also likely experience construction noise impacts. The nearest structures at Whitworth College are about 600 feet from the new tower sites; this area could be affected by noise from construction of the proposed project. The level of noise impacts at these areas is considered to be moderate.

Table 3-4. Construction Noise in the Vicinity of a Representative Construction Site

Distance from Construction Site (feet)	Hourly Leq (dBA)
50	89
100	83
200	77
400	71
800	65
1600	59
Note: The following assumptions were used: Equipment used: (1) each- grader, bulldozer, heavy truck, backhoe, Pneumatic tools, concrete pump, crane Reference noise level: 89 dBA (L_{eq}) Distance for the reference noise level: 50 feet Noise attenuation rate: 6 dBA/doubling of distance This calculation does not include the effects, if any, of local shielding or atmospheric attenuation.	

Noise levels generated during erection of each tower would depend on the type of method used. If conventional construction methods were used to erect the towers, then the noise levels would be comparable to those listed in Table 3-4. However, BPA's construction contractor may elect to use a large helicopter to assist with tower erection. In that case, all of the towers would be preassembled at one or more central staging areas, then a helicopter would transfer the assembled towers from the staging area to the remote tower sites. The helicopter would hover at each tower site for a total of 2 to 10 minutes during a 1-hour period while the tower sections are placed on the foundation. In addition, the helicopter would hover at the central staging area for 2 to 5 minutes per tower as it picked up each tower section. Homes within approximately 1 mile of the helicopters would be exposed to temporary noise levels above 65 dBA. However, helicopters operated during the daytime to support construction activity are exempted from Washington State noise regulations.

Impacts During Operation and Maintenance

Noise impacts during operation and maintenance of the proposed project would be negligible. About every two months, a helicopter would fly the line to look for any problems or repair needs. When and if these needs arise, field vehicles would be used to access the trouble spots.

The proposed line would increase the corona-generated foul weather audible noise level at the edge of the right-of-way. Audible noise levels were calculated for average voltage and average conductor heights for fair- and foul-weather conditions. The predicted levels of corona-generated audible noise for the proposed line operated at a voltage of 540 kV are given in Table 8 and plotted in Figure 4 in Appendix B-1.

At the edge of the right-of-way adjacent to the existing 500-kV line between Grand Coulee Switchyard and corridor mile 3/1, the foul weather L_{50} audible noise level would change by an indiscernible 1 dBA with the addition of the proposed line. The calculated median level (L_{50}) during foul weather at the edge of the proposed Grand Coulee - Bell 500-kV line right-of-way where there are no parallel lines (corridor mile 3/1 to 3/8, where there are no residences) is 49 dBA. The calculated maximum level (L_5) during foul weather at the edge of the right-of-way is 52 dBA. These levels are comparable to levels at the edges of some existing 500-kV lines in Washington and slightly lower than the levels from the existing Grand Coulee-Hanford 500-kV line between Grand Coulee Switchyard and corridor mile 3/1. Thus, audible noise levels for these areas would be comparable to those for existing 500-kV lines in Washington, and the level of impact is considered to be low.

For the remainder of the corridor with multiple parallel lines (except between corridor mile 83/1 and 83/6), the foul weather L_{50} audible noise level at the edge of the right-of-way would be 42 to 49 dBA. For these areas, audible noise from the proposed 500-kV line during foul weather would add 3 to 10 dBA to existing levels at the edges of the right-of-way. The response to such increases would range from barely perceptible to a perceived doubling of the sound level. The level of impact would range from low to moderate. Between corridor mile 83/1 and 83/6, which abuts commercial property, the edge-of-right-of-way audible noise levels would be 51 and 48 dBA at the north and south edges of the right-of-way, respectively. The noise standard for commercial areas is 55 dBA; therefore, the level of impact would be low.

During fair-weather conditions, which occur about 85 percent of the time in the Spokane area, audible noise levels at the edge of the right-of-way would be about 20 dBA lower than the foul weather levels (if corona were present). These lower levels could be masked by ambient noise on and off the right-of-way.

In conclusion, the calculated foul-weather corona noise levels for the proposed line where there are no parallel lines would be comparable to, or less, than those from existing 500-kV lines in Washington. During fair weather, noise from the conductors might be perceivable on the right-of-way, but beyond the right-of-way it would likely be masked or so low as not to be perceived.

During foul weather when ambient noise is higher, it is also likely that noise off the right-of-way would be masked to some extent. Where the proposed line is located in the center of a corridor with multiple existing lines, the increase of 10 dBA or less due to the addition of the 500-kV line would be perceived as at most as a doubling of the audible noise level at the edge of the right-of-way and beyond. The maximum impact level would be moderate.

Off the right-of-way, the levels of audible noise from the proposed line during foul weather would be below the 55 dBA level that can produce interference with speech outdoors. Since residential buildings provide significant sound attenuation (-12 dBA with windows open; -24 dBA with windows closed), the noise levels off the right-of-way would be well below the 45 dBA level required for interference with speech indoors and below the 35 dBA level where sleep interference can occur (EPA, 1973; EPA, 1978). Since corona is a foul-weather phenomenon, people tend to be inside with windows possibly closed, providing additional attenuation when corona noise is present. In addition, ambient noise levels can be high during such periods (due to rain hitting foliage or buildings), and can mask corona noise.

The 49-dBA level for the proposed line would meet the BPA design criterion and, hence, the Washington Administrative Code limits for transmission lines.

No transformers are being added to the existing Grand Coulee and Bell Substations. Noise from the existing substation equipment and transmission lines would remain the primary source of environmental noise at these locations. The large-diameter tubular conductors in the stations do not generate corona noise during fair weather and any noise generated during foul weather would be masked by noise from the transmission lines entering and leaving the station. During foul weather the noise from the proposed and existing lines would mask the substation noise at the outer edges of the rights-of-way.

In summary, the overall impacts from this project related to audible noise are low to moderate. Impacts would increase slightly in populated areas where audible noise from construction could be heard and where corona noise from the new line could be perceived. In the commercial area at the east end of the line near Bell Substation, corona noise from the line would increase foul weather noise levels by as much as 24 dBA at the edge of the right-of-way, resulting in a moderate impact. However, ambient noise is anticipated to be higher in this commercial area because of traffic and other activities.

Corona on transmission line conductors can also generate ***electromagnetic noise*** in the frequency bands used for radio and television signals. The noise can cause radio and television interference. In certain circumstances, corona-generated ***electromagnetic interference (EMI)*** can also affect communications systems and other sensitive receivers. Interference with electromagnetic signals by corona-generated noise is generally associated with lines operating at voltages of 345 kV or higher. This is especially true of interference with television signals. The bundle of three 1.3-inch (or 1.602-inch) diameter conductors used in the design of the proposed

500-kV line would mitigate corona generation and thus keep radio and television interference levels at acceptable levels.

Predicted EMI levels for the proposed 500-kV transmission line are comparable to, or lower, than those that already exist near 500-kV lines; no impacts of corona-generated interference on radio, television, or other reception are anticipated. If the proposed transmission line is found to be the source of radio or television interference in areas with reasonably good reception, BPA would take measures to restore the reception to a quality as good or better than before the interference (see Federal Communications Commission, Chapter 4 for further discussion).

Environmental Consequences of the Alternative Action

Construction noise impacts would be the same as for the Agency Proposed Action. The audible noise level increase for a double-circuit configuration would be slightly more (1 to 2 dBA) than for a single-circuit configuration at the same location. Therefore, noise impacts would be slightly greater in the adjacent residential neighborhoods in the north Spokane area where the double-circuit configuration would be used.

Cumulative Impacts

The noise analysis addresses cumulative impacts associated with the incremental addition of the 500-kV line within the existing corridor. No cumulative impacts are anticipated over most of the rural, undeveloped portions of the corridor. However, future increases in traffic and human activity related to population and economic development would increase background noise levels. This would most likely occur in the Spokane area and to a lesser extent in the Grand Coulee area. There are no known identified projects that would contribute to cumulative noise levels in these areas. Population levels are projected to increase by 11.6 percent in the Spokane area over the next 10 years, which would lead to higher levels of background noise in the future. The precise level of cumulative noise impacts is unknown.

Mitigation

To reduce the potential for temporary, adverse noise impacts during construction, the following measures would be incorporated into contract specifications.

- All construction equipment would have sound-control devices no less effective than those provided on the original equipment.
- All construction equipment and vehicles would have muffled exhaust.
- Construction activities would be limited to daytime hours (i.e., construction would occur only between 7:00 am and 10:00 pm).

- Landowners directly impacted along the corridor will be notified prior to construction activities.
- If radio or television interference occurs, measures would be taken to restore the reception to a quality as good or better than before the interference.

Environmental Consequences of the No Action Alternative

Existing background noise levels in the project vicinity would continue under the No Action Alternative. No new noise impacts would be expected.